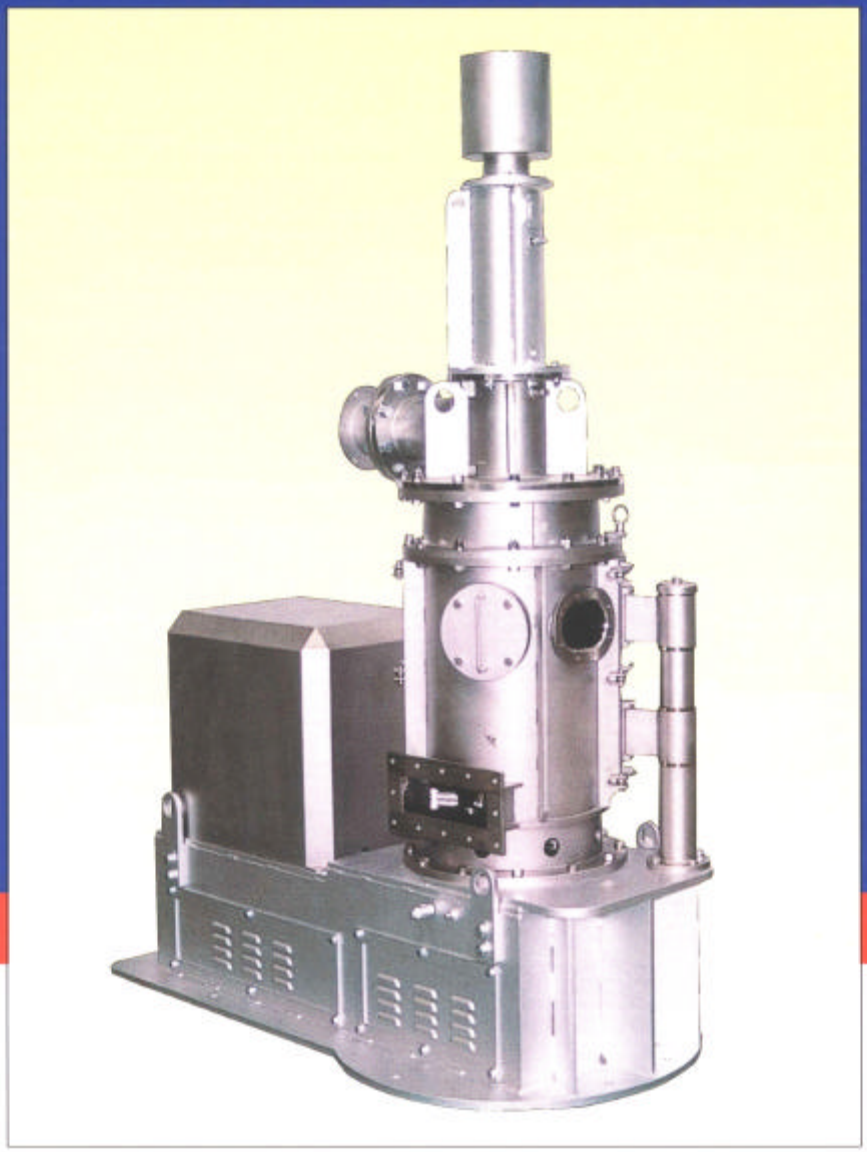
HOSOKAWAMICRON

DRYMEISTER®

Super Flash Dryer
Dries even solution or slurries.



Process Technologies for Tommorrow

HOSOKAWA MICRON CORPORATION

BEPEX · ALPINE · MICRON · VRIECO-NAUTA · STOTT

New Generation Powerful Flash Dryer Enables Direct Drying of Solution & Slurries.

General

Pneumatic conveying dryers utilise hot air streams to produce powdery products from wet materials such as slurries,wet cakes etc. A dispersion or mill section can be used to disperse the slurries, or wet cakes into the hot air stream.
The Drymeister is a new dryer in this field with added dispersion capabilities allowing even "sticky/cohesive" materials to be processed, therefore widening the application range for air flow dryers.
The Drymeister has a built-in grinding and classification section which incorporates a strong fine pulverizer and an air classifier to control the product particle size leaving the dryer.
As a result of the combination of the pulverizer and classifier, the product particle size and product moisture content can be easily controlled and adjusted, providing a uniform dry product. The Drymeister has a high heat transfer coefficient enabling the system to be constructed in a compact design.

Photo.1

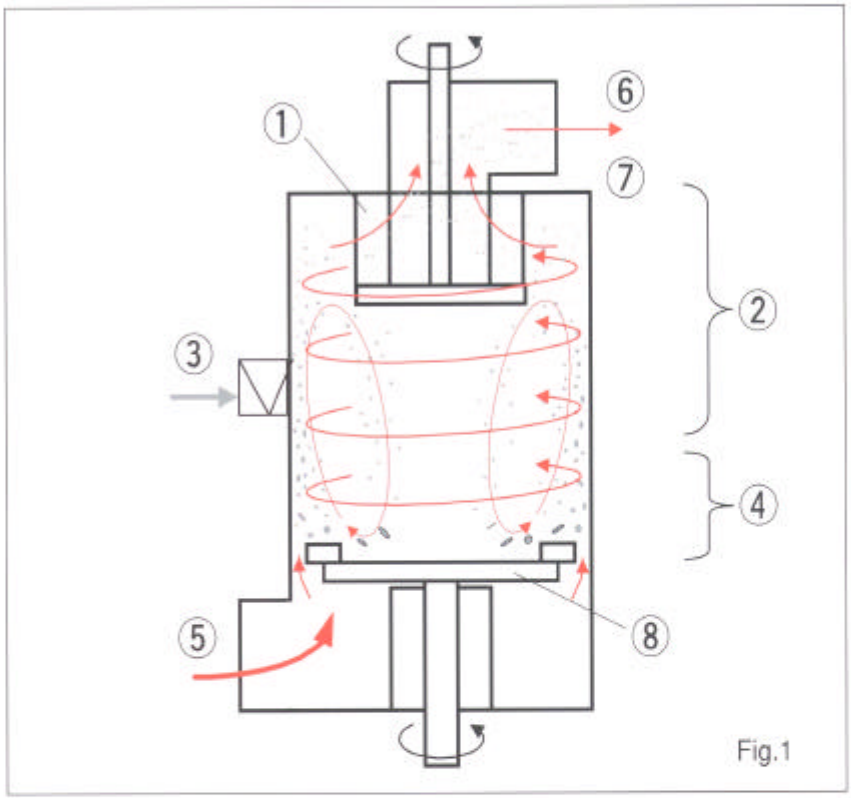


Fig.1

Fig.1
① Classifying Rotor
② Classifying Section
③ Material Feed Inlet
④ Grinding Section
⑤ Hot Air
⑥ Dry Product
⑦ Exhaust Back Filter
⑧ Grinding Rotor

Description of Construction and Process Principle

Figure 1. shows the main structure of the Drymeister. The Drymeister construction is a vertical and cylindrical structure, where the grinding section is placed at the bottom.
Wet material which can have a wide ranging moisture content is fed into the grinding and drying section of the dryer main body. The impact energy imparted by the grinding rotor disperses the wet material into very fine particles. A temperature controlled hot air stream from the air heater is drawn by the exhaust fan through the main body and fluidises the fine particles in the grinding chamber. This condition guarantees optimal heat exchange and instant evaporation of moisture.
The dried particles are conveyed with the air stream to the top of the body where there is the air classifier which classifies the particles by size & moisture. Particles passing the classifier below the set cut point are conveyed and collected in the collector as product. The oversize & over moisture particles are returned at the grinding section at the bottom of the body for further processing.

Drying of Solution, Slurry and High Adhesive Materials

Features

i) High-drying performance and noinner adhesion

The new design of the grinding section and high speed dispersion rotor greatly enhances the grinding and dispersion capabilities. The strong impact force and a whirl of air generated in the mill by the high speed dispersion rotor enhances the material dispersion. in the airflow, and dramatically increases the drying efficiency. As a result, adhesion of non-dry moisture material on the inner walls of the casing scarcely occurs.

ii) Drying of solution, slurry and strong adhesive materials

A special dispersion rotor is used to dry solution, slurries, and strong adhesive materials which cannot be processed by conventional dryers due to the cohesive nature.

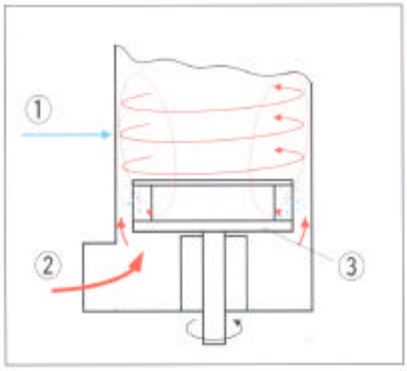
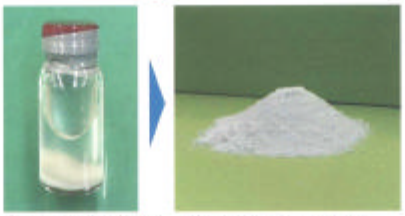


Fig. 2
① Pumping liquid material
② Hot air
③ Special dispersion rotor

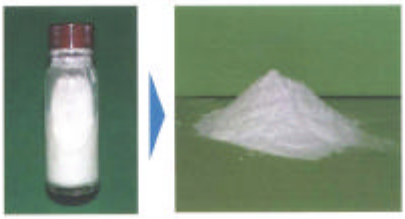
☐ Additive agent for food



Raw material: 60% WB solution

Product moisture content: 0.7% WB

☐ Synthetic detergent



Raw material: 60% WB solution

Product moisture content: 3.2% WB

Photo 2. Application examples

iii) Powerfully improved dispersing&milling performauce

Due to powerful dispersion/milling force as well as accurate classifier,one unit of Dry Meiser can produce uniform powdery products by one prosess.

iv) Easy product size control

General airflow dryers cannot easily control product size, however the Drymeister with its built-in air classifier can easily control the desired particle size by changing the classifier speed. Materials are pulverized in the grinding section and air conveyed to the classifying section in the dryer.

Here,the dried particles are influenced by the two forces,the centripetal force of the air and the centrifugal force of the classifying rotor. Fine, thus dried-enough particles,more susceptible to centripetal force, are carried on the air flow throuht the rotor and collected as a dry fine product. On the other hand, coarse, not-dried-enough particles, more susceptible to centrifugal force, flow down the inside wall of the machine and returns to the lower grinding/drying section for further processing.

Cut point means the point where the two forces influence evenly. By the speed change of the classifying rotor, the cut point can be easily changed thus adjusting moisture/particle size to be classified.

Fig. 3
Comparison with Conventional model

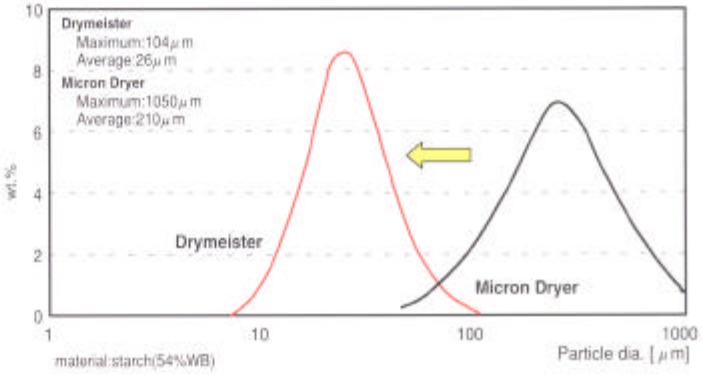


Fig.3

Compact Design - Smaller than the conventional machine

v) Easy product moisture control

The product moisture content is controlled by adjustment of both temperature and residence time of the material in the Drymeister. Normally, if particles are larger than the specified diameter, they are of a higher moisture content and are not produced as products. Adjustment of product moisture content can be controlled by the classifier rotor speed and dryer outlet temperature. Although it also depends on the product fineness,the general relationship between the dryer outlet temperature and the product moisture content is shown on the table1

Relationship of the product moisture content with the dryer outlet temperature:

Product Moisture Content (WB)	Dryer Outlet Temperature
12 ~ 5%	50 ~ 60℃
5 ~ 3%	60 ~ 80℃
3 ~ 1%	80 ~ 100℃
Below 1%	100 ~ 110℃

table1

vi) Compact design of the System

The powerful grinding and dispersion mechanism disperse and agitate the feed material with the hot air flow. Therefore the required heat exchange is almost instantly completed.
Some particles, which are not instantaneously dried in the grinding section, are also completely dried within the dryer as the particles are agitated again in the classifying section with hot air flow.
Therefore, even if the material has a high moisture content, or products with low moisture content are required, the drying action are completed within the dryer, so that long drying ducts are not needed, and products can be discharged from, the collector beside the dryer.
Meanwhile, enhancement of the drying performance reduces the equipment body height by 30-50% compared to the conventional Micron Dryer.

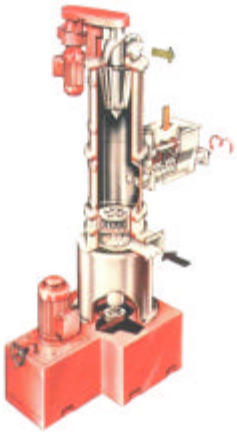


Photo 3 Micron Dryer

Photo 4 Drymeister

Photo 6. DMR-1

Photo 5 Drymeister

Typical Application

Material Name	Feed Condition	Material Moisture Content(%W.B.)	Product Moisture Content(%W.B.)	Product Particle size	Inlet Hot Air Temperature [℃]	Outlet Temperature [℃]
PCC (Precipitated Calcium Carbonate)	Wet Cake	36	0.4	d50=15㎛	300	80
	Paste	45	0.5	d50=8㎛	350	80
	Slurry	60	0.3	d50=28㎛	250	80
Cellulose	Wet Cake	60	1.4	−75㎛59%	150	70
Wheat flour	Slurry	60	4.0	d50=28㎛	160	80
Coloring agent	Clayey	44	2.3	d50=3㎛	200	120
Fertilizer	Wet Cake	47	0.9	−75㎛98%	200	80
Pigment	Wet Cake	52	0.8	d50=0.8㎛	200	100
Dye	Clayey	55	1.1	Top size:100㎛	300	120
Food additive	Aqueous solution	60	0.7	Top size:300㎛	180	120
Synthetic detergent	Aqueous solution	60	4.3	Top size:250㎛	200	100
Metallic oxide	Wet Cake	30	0.1	Top size:8.5㎛	250	110
Polymerized Toner	Slurry	42	0.15	d50=7.1㎛	130	50
Residue of Soy Beans	Wet Cake	76	4.5	d50=35㎛	350	80
Rechargeable Battery (Cathode Material)	Slurry	42	0.5	d50=4.5㎛	250	130
Ceramics	Slurry	48	0.06	d50=0.5㎛	200	120
Pharma additives	Wet Cake	60	0.3	d50=22㎛	200	80

Table 2

Dinensional Drawing

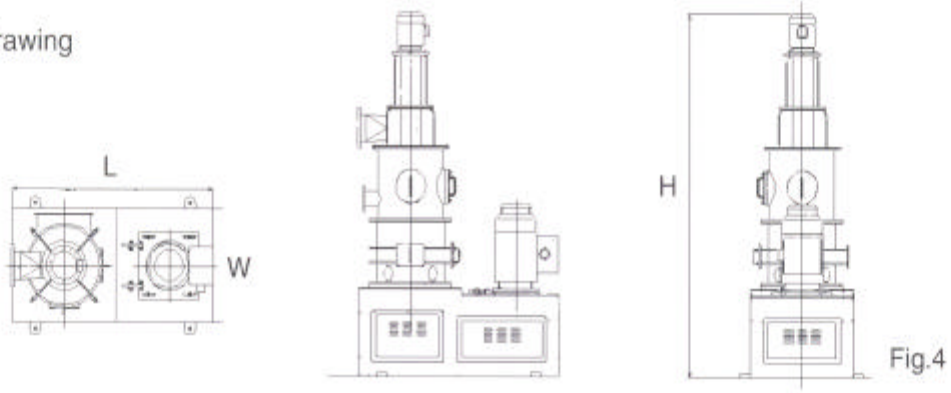


Fig.4

Specification

Type		DMR-1	DMR-2	DMR-3	DMR-4	DMR-5	DMR-6	DMR-7
Height	[mm]	2500	3100	3700	4800	5700	6500	7300
Length	[mm]	1400	1800	2300	2500	3300	4500	5000
Width	[mm]	750	1100	1300	1700	2100	2600	3200
Grinding drive Power	[kW]	~11	~22	~45	~90	~200	~280	~355
Classifying drive Power	[kW]	~1.5	~3.7	~7.5	~15	~30	~37	~55
Typical Outlet Air Flow at 80℃	[m^3/min]	25	50	100	200	400	600	800
Inlet Gas Tempevatuve	[Max.℃]	450	450	450	450	450	450	450
Evaporation Capacity	[kgH_2O/Hr]	200	390	780	1550	3100	4650	6220
Approx. Weight	[kg]	800	2200	3500	5500	6000	8000	10000

Note : Evaporation capacity is based on the couditions of inlet gas temperatuvel of 400℃ & outlet tempevature of 100℃.
Special design for maximum inlet gas temperature of 600℃ is also available

Table 3

Ancillaries for Complete Systems

1) Hot Air heater system

There are a number of systems that can be used to supply the hot air required in the Drymeister.
In many cases, hot air is utilized by combustion of liquid oils, since high temperature can be obtained at relativery low cost. However, there is a possibility of incomplete combustion which produce carbon and sulfur eventually contaminating materials.
So indirect heating method may be preferred for materials such as dyestuff, pigment, pharmaceuticals, foods and some chemicals. Heat exchanger is additionally placed to obtain clean hot air. Or gas fuel such as LPG is used otherwise.
When permissible temperature of the material is low, a steam heater may be used.

2) Material Feeder

Critical point for operation of Drymeister is the control of wet feed material. To select a feeder, it is critical to grasp the characteristics of wet feed materials.
The most important function of feeder is to continuously feed wet material at constant rate, without leakage of gas to or from the dryer. To ensure this function, it is also necessary not to generate troubles such as bridging or blocking at a meterial hopper or a chute.
For granular or powdery materials normally a screw feeder is selected. Such feeder is directly connected to the dryer. For very cohesive wet or sticky materials, agitators may be necessary in the bottom part of feed hopper. Number of screws can be one, two or four. Blade shape can be continuous, cut, spiral, and ribbon shape, depending on characteristics of feed. When double or four screws are used, normally adjacent screws are positioned to be overlapped, to force the wet material to move into the dryer.

3) Product Collector

Important points are high collection yield, low pressure drop, as well as minimum fluctuation of pressure loss and air volume for stable operation. Normally products from the Drymeister is directly collected at a bag filter, without use of a cyclone.
Even if the exhaust air temperature is high, heat resistance, filter bag can with stand up to 200℃.

4) Blower

Since the standard system flow of the Drymeister (fig 5) requires static pressure of approximately 600 - 1200mmAq in the entire system, a turbo blower is normally used.
It is required to select a suitable blower of which air volume is not influenced too much by fluctuation of system pressure.

Typical Flow Charts

1) Standard Flow

Fig. 5 shows a standard system flow.

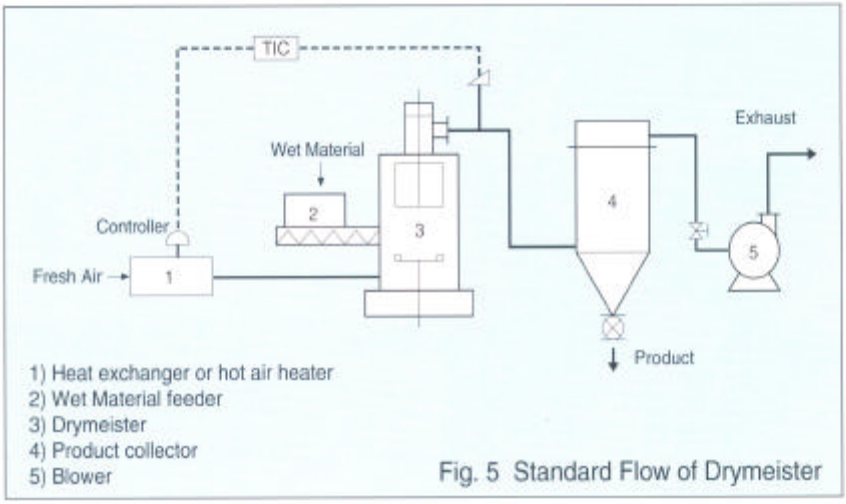


Fig. 5 Standard Flow of Drymeister

2) Slurry Drying Flow

1) Heat exchanger or hot air heater
2) Slurry pump
3) Drymeister
4) Product collector
5) Blower

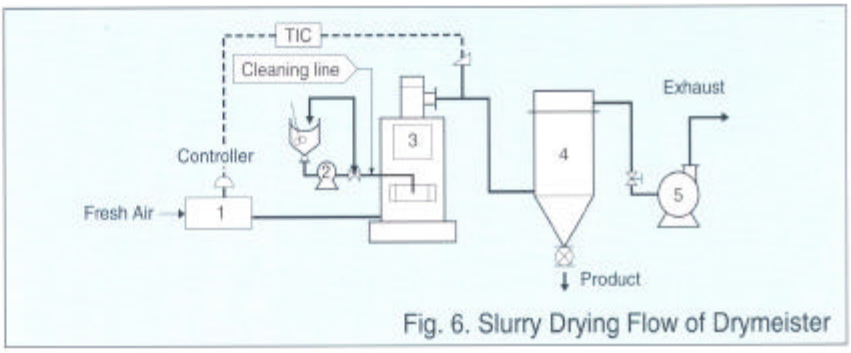


Fig. 6. Slurry Drying Flow of Drymeister

3) Energy saving flow

To save energy, part of the exhaust air (more than half) from the system is returned to the hot air heater, or heat exchanger, and fed back into the dryer after mixing with fresh air. Using this method, moisture of hot air to the dryer rises slightly, however, this is not critical to the process. This is shown in fig 7.

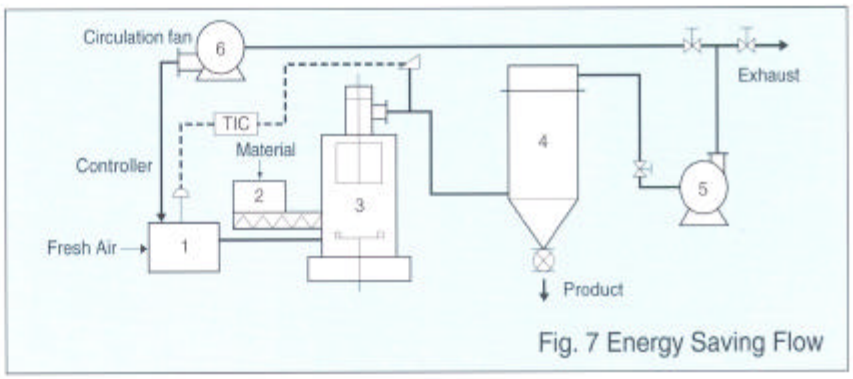


Fig. 7 Energy Saving Flow

4) Closed Circuit Flow

When a material contains organic solvent, it must be dried in nitrogen or an inert gas atmosphere. Also it is necessary to avoid the process gas being exhausted into the atmosphere as low as possible.
In this case, fig 8. shows the flow, where the prosess gas is completely circulated and isolated from the outside.
Some portion of the circulating gas should be exhausted to the atmosphere since fresh gas is taken into the circuit for combustion.

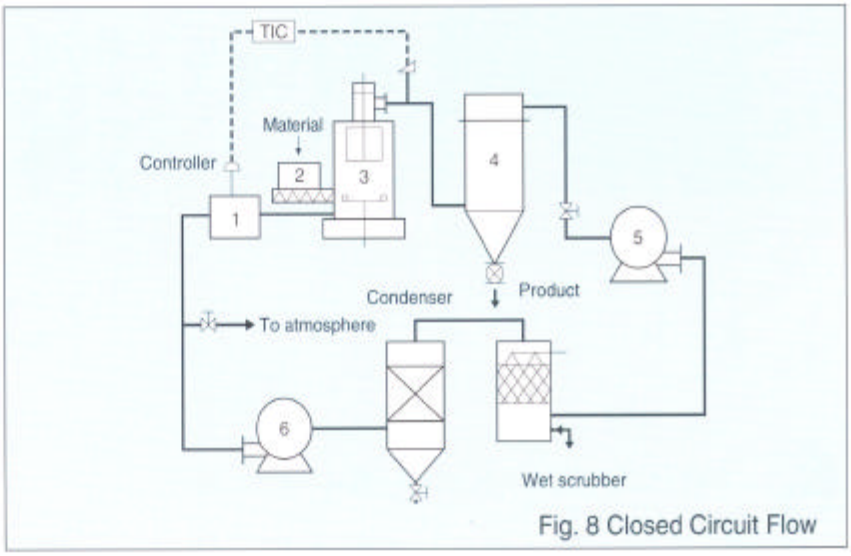


Fig. 8 Closed Circuit Flow

5) Temperature control system

As shown in fig.5 to 8, the inlet temperature is controlled against fluctuation of the feed material moisture, and feeding rate or feed stop, thus keeping the outlet temperature constant.
As such system is used, product temperature can be constantly maintained at all times, eliminating the possibility of bag filter firing.

Hosokawa Global Network

Head quater

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